

INTERNATIONAL
ASSOCIATION FOR TESTING MATERIALS.

AMERICAN SECTION.

BULLETIN No. 14.

MAY, 1900.

PROPOSED STANDARD SPECIFICATIONS
FOR
STEEL TIRES.

RECOMMENDED BY AMERICAN BRANCH OF COMMITTEE NO. 1, MAY 1, 1900.

There will be a discussion of these specifications at the Third Annual Meeting of the American Section, to be held in New York, on October 25-27, 1900, and you are requested to send in your views by letter, or to be present and take part in the oral discussion.

After the Annual Meeting, Committee No. 1 will consider the points raised, and make any modifications that may be found necessary; and, if so decided at the Annual Meeting, the specifications will be sent to all members of the American Section for approval by letter ballot.

If the other countries perform their work in the same general manner, the final work of the introduction of International Specifications will be reduced to a very simple matter, as there will only be a limited number of specifications to consider instead of hundreds as at the present time.

WM. R. WEBSTER,
Chairman of American Branch of Committee No. 1.

PROCESS OF MANUFACTURE.

1. Steel for tires may be made by either the open-hearth or crucible process.

CHEMICAL PROPERTIES.

2. There will be three classes of steel tires which shall conform to the following limits in chemical composition :

	Passenger engines. Per cent.	Freight engine and car wheels. Per cent.	Switching engines. Per cent.
Manganese shall not exceed .	0.80	0.80	0.80
Silicon shall not be less than .	0.20	0.20	0.20
Phosphorus shall not exceed .	0.05	0.05	0.05
Sulphur shall not exceed	0.05	0.05	0.05

PHYSICAL PROPERTIES.

3. The minimum physical qualities required in each of the three classes of steel tires shall be as follows :

	Pas- senger engines.	Freight engine and car wheels.	Switch- ing en- gines.
Tensile strength, pounds per square inch.	100,000	110,000	120,000
Elongation, per cent in two inches	12	10	8

4. In the event of the contract calling for a drop test, a test tire from each melt will be furnished at the purchaser's expense, provided it meets the requirements. This test tire shall stand the drop test described in paragraph No. 7, without breaking or cracking, and shall show a minimum deflection equal to $D^2 \div (40T^2 + 2D)$, the letter "D" being internal diameter and the letter "T" thickness of tire at center of tread.

TEST PIECES AND METHODS OF TESTING.

5. The standard turned test specimen, one-half inch ($1/2''$) diameter and two inch ($2''$) gauged length, shall be used to determine the physical properties specified in paragraph No. 3. It is shown in the following sketch :

Test Specimen for
Tensile Tests.



Name.	Designation.	Diameter.	Test pieces for Chemical Analysis.	Chemical Composition.										Test piece.
				Carbon.		Phos- phor- us.		Man- gan- ese.		Sul- phur.		Silicon.		
		Min.		Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
		Per cent.												
Inches.														
Baltimore & Ohio RR., Jan. 13, 1890.....	Passenger engine. Freight. Switch engine, cars, etc.	60 and over. Between 45 and 60. 46 and under.	Tire turnings and broken test pieces.	.50 .60 .68	.60 .70 .78	.........	.06 .06 .06	.........	.70 .70 .70	.........	.04 .04 .04	.........	.25 .25 .25	{ ¾-in. dia. × 4½ in. long between shoulders taken from an ingot of same heat from which tire is rolled.
Southern Railroad Co., Alabama / Great Southern RR., May 12, 1899 }	Engine. Engine and truck.	50 or over Under 50.	Tire turnings and broken test pieces.	{	...	...	.05	...	.70	...	.045	...	.30	{ From each heat which has received same amt. of work as tires ¾ in. dia.
London and Southwestern of Eng- land, received by us in 1899														{ 2 test pieces machined 'old from tire.
Japanese, received by us in 1899														
Oude and Roohilkund Railway, re- ceived by us in 1899.....														{ Cut cold from tested tires and turned to dimensions used at Woolwich for gun tests. From tested tire test process of original area of ½ in. sq. in. (.798 dia.) and effective length between datum points of 2 in.
New South Wales Government Railways, June 7, 1898														
Cross Creek Coal Co., Feb., 10, 1898. { Egyptian Railways and Telegraph, received by us in 1899.....	Medium grade. Hard grade.	{		.60 .68	.70 .78	......	.05 .05	......	.70 .70	......	.04 .04	......	.25 .25	{ Area of ¼ sq. in. by effective length of 2 in.
Livesey's Sons and Henderson, C- 345, received by us in 1899.....														{ Cut cold from tested tire a test piece of area of ¼ sq. in. and an effective length of 2 in.
Burma R'ys Co., Ltd			Broken test pieces.	.55 .63	...	...	.035 ...	...	1.00...	...	.035...	...	.35	{ Cut cold from test tire, diam. .561 in., 2 in. effective length.
Livesey's Sons and Henderson, D- 700, received by us in 1899														
Midland Railway England, received by us in 1899.														{ Cut cold from test tire. 2 in. effective length.
Russian Gov't No. 113, received by us in '98 and '99.....														{ 8 in. effective length, 8 in. diam. cut from test tire.
Finland State R'ys, received by us in 1898.....														{ Cut cold from test tire. 8 in. effective length .5 in. diam. Test specimen from each heat forged 8 in. long x 1¼ in. diam. with approx. same work as tire
C. B. & Q. R.R., received by us in 1893.....	Loco. tires, pass. and Switch engines.			.55 .65	.65 .75	......	.05 .05	......	.70 .70	......	.04 .04	......	.25 .25	

SYNOPSIS OF SPECIFICATIONS FOR STEEL TIRES.

COMMITTEE NO. 1.—AMERICAN SECTION, INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS.

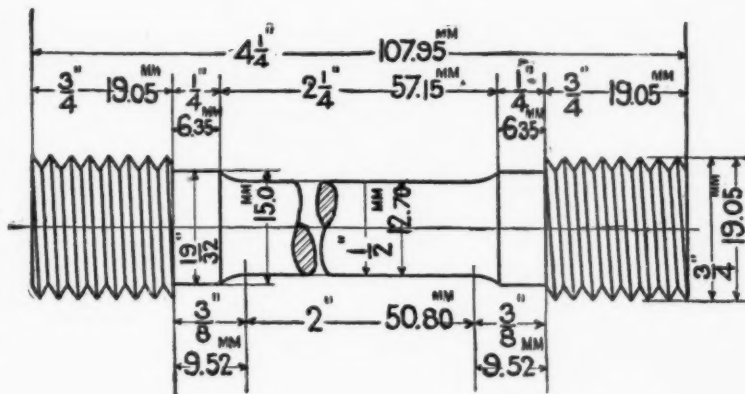
	Physical properties.						Drop Test.		Drop Test.		Dimensions of finished tire.	Finish.		
	Ultimate strength.			Elongation.		Reduction of area.	Bend.	Weight of drop.	Height of drop.	Minimum Deflection.				Remarks.
	Desired.	Min.	Max.	Desired.	Allowed variation.									
Pounds per sq. in.	Per cent.					lbs.	feet.							
between ingot and tire	105,000	95,000	115,000	16 in 4 in.	2 below.	}						Conform to dimensions shown on drawings furnished by company.	Free from cracks, flaws or other imperfections.	
	115,000	105,000	125,000	14 in 4 in.	"									
	125,000	115,000	135,000	10 in 4 in.	"									
s re- k as {	105,000	120,000	15 in 4 in.	Decrease of 1 for increase of 5,000 lbs.		}						Difference in outside circumferences of tires must not be more than 1/8 in.	Free from cracks, flaws or other imperfections.	Each tire number maker.
	115,000	130,000	13 in 4 in.											
old }	98,560		15 in 2 in.				2,210	{ 10, 15, 20, 25, 30 and upwards. }	1/2 external diameter.	{ 1 additional tire for each 50 ordered selected and must stand test without breaking or cracking.	Turned so that diam. and thickness shall be exactly similar.		Each tire name, date number of	
	100,000	107,000			20				2 in. per ft. of diameter	{ 2 tires tested without showing any signs of fractures.				
and d at }	100,800		20				2,240	{ 5, 10, 15 and upwards. }	2 in. per ft. of diameter.	{ 2% of tires tested without showing any signs of flaws or cracks.			Maker's fracture, of tire, netter paint	
	103,010	112,000	15 in 2 in.		25	2,240	{ 10, 15, 20, 25 and upwards. }	1/2 external diameter, small bogie less than 3 ft., 1/8 external diameter.	{ 1 additional tire for every 50 ordered selected, and must stand test without breaking or cracking.					
cess q. in- ngth 2 in. }	112,000	123,200	14 in 4 in. 12 to 15 in 2 in.					{ Various heights up to 25. }	1/2 diameter.	{ Without showing any signs of fracture.				
	118,720	114,240	123,200	10 in 2 in.		2,210	{ 5, 10, 15, 25 and upwards. }	3/4 internal diam. small tires less than 3 ft., 1/8 tires outside dia., 28 in. x 3 in. tread 1/8 inside.	{ Tire test will be made for each blow, and in no case less than 2% of order. No signs of a fracture.					
am. th. }	107,520	116,480	11% with max. ult. 15% with min. ult.				2,210	10 and upwards.	1/2 of 1 D.	{ 1 tire from each heat.	To drawing.		Maker's fracture,	
									D ² + 40T ²	{ D = internal diameter. T = thickness of tire of centre of tread.				
2 in. }	100,000	108,000	20% in 2.			{ 1/4 sq. angle 55% rad. 3/4 in. }	2,210	{ 10 ft. and upwards, or hyd. press. }	3 def. for each ft. of 1 D.				Stamped in. high. and number circumference	
	99,546		8% in 8 in.	90 - 1422 = Elong. x 2					{ Tires 2.56 in. thick stand 3 blows of 1102 lbs., drop, height 13 3/4 ft. or equivalent in ft., lbs.; ht. increased or decreased 7.4 in. for 1/4 in. inc. or dec. in thickness of tire. 1% to be tested.	{ 1 tire from each heat or 2% }				
8 in. am. heat tire }	92,440	99,550	15% in 8 in.					{ 300 kilogramme-ters, momentum. }	1/2 external diameter.	{ 1 tire from each heat or 2% }	To gauge.	{ Free from im- perfections. }		

SYNOPSIS OF SPECIFICATIONS FOR STEEL TIRES.

COMPILED FOR COMMITTEE NO. 1.—AMERICAN SECTION, INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS.

Chemical Composition.								Test piece.	Physical properties.						Drop Test.		Minimum Deflection.		
Phosphorus.		Manganese.		Sulphur.		Silicon.			Ultimate strength.			Elongation.		Reduction of area.	Bend.	Weight of drop.		Height of drop.	
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.		Desired.	Min.	Max.	Desired.	Allowed variation.						
Per cent.								Pounds per sq. in.			Per cent.			lbs.	feet.				
.0670	...	.04	...	.25	{ 3/4-in. dia. x 4 1/2 in. long between shoulders taken from an ingot of same heat from which tire is rolled.	105,000	95,000	115,000	16 in 4 in.	2 below.	{						
.0670	...	.04	...	.25		115,000	105,000	125,000	14 in 4 in.	"							
.0670	...	.04	...	.25		125,000	115,000	135,000	10 in 4 in.	"							
.0570	...	.045	...	.30	{ From each heat which has received same amt. of work as tires 3/4 in. dia.	.....	105,000	120,000	15 in 4 in.	Decrease of 1 for increase of 5,000 lbs.	{						
.....	115,000	130,000	13 in 4 in.								
.....	98,500	15 in 2 in.							2,210	{ 10, 15, 20, 25, 30 and upwards.	1/2 external diameter.
.....	{ 2 test pieces machined cold from tire.	.....	100,000	107,000	.....	.....	20				2 in. per ft. of diameter.		
.....	{ Cut cold from tested tires and turned to dimensions used at Woolwich for gun tests.	100,800	20	2,240					{ 5, 10, 15 and upwards.	2 in. per ft. of diameter.
.....	{ From tested tire test process of original area of 1/2 sq. in. (.798 dia.) and effective length between datum points of 2 in.	103,010	112,000	15 in 2 in.	25					2,240	{ 10, 15, 20, 25 and upwards.	1/2 external diameter. small bogie less than 3 ft., 1/8 external diameter.
.0570	...	.04	...	.25	{ Area of 1/4 sq. in. by effective length of 2 in.	.....	.....	.....	14 in 4 in.	.....	{					
.0570	...	.04	...	.25		.....	112,000	123,200	12 to 15 in 2 in.	.....						
.....		{ Cut cold from tested tire a test piece of area of 1/2 sq. in. and an effective length of 2 in.	118,720	114,240	123,200	10 in 2 in.			2,240	{ 5, 10, 15, 25 and upwards.	1/4 internal diameter. tires less than 3 in. tires outside diameter, x 3 in. tread 1/8 in.	
.035	1.00	.....	.035	.....	.35	.....	{ Cut cold from test tire, diam. .564 in., 2 in. effective length.	.....	107,520	116,480	11 1/2 with max. ult. 15 1/2 with min. ult.	.....	{		2,210	10 and upwards.	1/2 of 1 D.
Arsenic under .02.							
.....		{ Cut cold from test tire. 2 in. effective length.	100,000	108,000	20 in 2 in.			{ 1/4 sq. angle 55 deg. rad. 3/4 in.	2,210	{ 10 ft. and upwards, or hyd. press.	3 def. for each ft. of drop.
.....	{ 8 in. effective length, 8 in. diam. cut from test tire.	.....	99,546	.....	8 in 8 in.	Ult. 90 - 1422 = Elong. x 2	{				Tires 2.56 in. thick. drop, height. 13 3/4 in. increased or decreased in thickness of 1/4 external diameter.		
.....	{ Cut cold from test tire. 8 in. effective length .5 in. diam. Test specimen from each heat forged 8 in. long x 1 1/4 in. diam. with approx. same work as tire	.....	92,440	99,550	15 in 8 in.	.....						
.05700425						{ 300 kilogrammeters, momentum.	
.0570	...	.04	...	.25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Drop Test.		Dimensions of finished tire.	Finish.	Branding.	Inspection.
Amount Deflection.	Remarks.				
		Conform to dimensions shown on drawings furnished by company.	Free from cracks, flaws or other imperfections.		Maker must furnish inspector analysis of heat from which tire ingot and test ingot were obtained. Analysis of test ingot must agree with tire ingot. Maker must furnish inspector all necessary facilities for inspection. Analysis of test pieces must agree with analysis of turnings from any of tires made from same heat.
		Difference in outside circumferences of tires must not be more than $\frac{1}{8}$ in.	Free from cracks, flaws or other imperfections.	Each tire stamped with serial number, heat number and makers' name.....	
Internal diameter.	1 additional tire for each 50 ordered selected and must stand test without breaking or cracking.	Turned so that diam. and thickness shall be exactly similar.		Each tire stamped with maker's name, date of manufacture, and number of charge.	
1 ft. of diameter	2 tires tested without showing any signs of fractures.				
2 ft. of diameter.	2% of tires tested without showing any signs of flaws or cracks.				
Internal diameter, 3 ft. or less than 3 ft.	1 additional tire for every 50 ordered selected, and must stand test without breaking or cracking.			Maker's name, date of manufacture, stamped on outer edge of tire, near inner circle. Class letter painted white inside of tire.	
Internal diameter, 3 ft. or less than 3 ft.	Without showing any signs of fracture. Tire test will be made for each blow, and in no case less than 2% of order. No signs of a fracture.				
Internal diam. small					
Less than 3 ft., $\frac{1}{8}$ in. or less					
Side dia., 28 in.					
Head $\frac{1}{8}$ inside.					
of 1 D.	1 tire from each heat.	To drawing.		Maker's name, date of manufacture, number of contract.	Person approved by Company's Engineer.
$F + 40T^2$	D = internal diameter. T = thickness of tire of centre of tread.				
For each ft. of 1 D.					
2.56 in. thick stand 3 blows of 1102 lbs., 13 3/4 ft. or equivalent in ft., lbs.: ht. and or decreased 7.4 in. for 1/4 in. inc. or thickness of tire. 1% to be tested.				Stamped .16 in. deep, figures. 4 in. high. Maker's name, date and number 1/8 in. from internal circumference.	
Internal diameter.	1 tire from each heat or 2%.	To gauge.			
			Free from imperfections.		



6. When the drop specimen is specified, this test specimen shall be cut cold from the tested tire at the point least affected by the drop test. If the diameter of the tire is such that the whole circumference of the tire is seriously affected by the drop test, or if no drop test is required, the test specimen shall be forged from a test ingot cast when pouring the melt, the test ingot receiving, as nearly as possible, the same proportion of reduction as the ingots from which the tires are made.

Location of Tensile Specimens.

7. The test tire shall be placed vertically under the drop in a running position on a solid foundation of at least ten tons in weight and subjected to successive blows from a tup weighing 2240 pounds, falling from increasing heights until the required deflection is obtained.

Drop Test Described.

8. Turnings from the tensile specimen, or drillings from the small test ingot, or turnings from the tire if preferred by the inspector, shall be used to determine whether the melt is within the limits of chemical composition specified in paragraph No. 2.

Sample for Chemical Analysis.

FINISH.

9. All tires shall be free from cracks, flaws, or other injurious imperfections, and shall conform to dimensions shown on drawings furnished by the purchaser.

BRANDING.

10. Tires shall be stamped with the maker's brand and number in such a manner that each individual tire may be identified.

INSPECTION.

11. The inspector representing the purchaser, shall have all reasonable facilities afforded to him by the manufacturer to satisfy him that the finished material is furnished in accordance with these specifications. All tests and inspections shall be made at the place of manufacture, prior to shipment.